

Ultraviolet Radiation Exposure

INTRODUCTION

Workers can be exposed to natural or man-made ultraviolet (UV) radiation. Like all light energy, UV travels through space in waves. We categorize light based on the length of those waves. UV waves are too short to be visible to the naked human eye, but UV is the most damaging element of sunlight. Cumulative exposure to UV radiation can cause damage to corneas, and lead to cataracts or even permanent blindness. For the purposes of this chapter, UV radiation can be divided into categories; UVA (400-315nm), UVB (315-280nm), and UVC (<280nm). Natural exposures (solar) of UV light are a concern for people working in the outdoors during the workday. Man-made UV exposures are of great concern here at Fermilab due to the prevalence of their use and the portion of the light spectrums used. UV radiation is used in many applications; UV curing adhesives, Light Emitting Diodes (LEDs), etc. Exposure to UV radiation can also occur from welding, burning and brazing operations and work activities occurring outdoors.

This chapter does not cover laser sources; these forms of electromagnetic energy require special consideration. Guidance on lasers can be found in FESHM chapter [5062.1](#).

APPLICABLE GUIDANCE

American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) 2005 (Latest Ultraviolet Radiation documentation is 2001)

DEFINITIONS

LED - light-emitting diode: a semiconductor diode that emits light when conducting current and is used in electronic equipment, esp. for displaying readings on digital watches, calculators, etc.

Ultraviolet (UV) radiation - electromagnetic radiation with a wavelength shorter than that of visible light, but longer than soft X-rays. For the purposes of this chapter, UV radiation can be divided into categories; UVA (400-315nm), UVB (315-280nm), and UVC (180-280nm).

Interlocked - With regard to a UV radiation enclosure, "interlocked" means that UV radiation levels are automatically reduced to harmless levels when a

protective enclosure is opened. If the interlock is not failsafe, an appropriate warning label must also be attached to the enclosure.

Laser Safety Officer (LSO) - The individual who assures that laser and UV hazards are adequately monitored, evaluated, and controlled.

Locked - With regard to a laser radiation enclosure, "locked" means that a tool is required to gain access to the UV radiation source and an appropriate warning label has been attached to the enclosure.

Threshold Limit Value (TLV) - Recommended guidelines published by the ACGIH for occupational exposure to airborne contaminants or in the case of this chapter a physical agent.

Tool - With regard to a UV radiation enclosure, the requirement for a "tool," when used in conjunction with a warning label greatly reduces the likelihood of inadvertent access to hazardous UV radiation levels. A key to a lock is considered a tool for the purposes of this chapter.

SPECIAL RESPONSIBILITIES

Senior Laboratory Safety Officer (SLSO) will:

- consult and oversee the lab-wide evaluation and control of UV hazards including system classification, procedures, protective equipment, warning systems, facilities, and training.

Division/Section ES&H group personnel will:

- play a consultative and oversight role for UV hazards pertaining to their division/section.
- work with division/section personnel to identify, label, and provide safety guidelines for operations that may emit hazardous UV radiation
- perform investigations of incidents involving UV radiation

Medical Department will:

- evaluate employees with special concerns (i.e. medical conditions or medication that may make a person more susceptible to UV exposure) on a case-by-case basis when UV light usage may result in an exposure.

PROCEDURES

Below is a summary of Fermilab's UV safety requirements. Precautions for UV hazards are presented according to light spectrum and are based on the latest

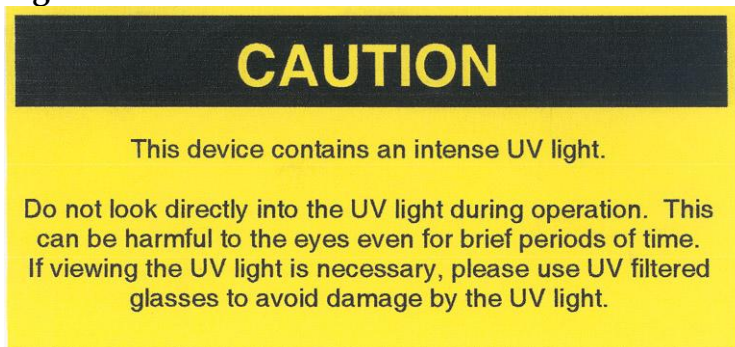
version of the applicable guidance, ACGIH TLVs and BEIs 2005. Though general in nature, this information provides a solid basis for understanding the required actions. Guidance is available in the ACGIH TLVs and BEIs 2005.

UV LED and other UV light sources (Required)

- Notify the division/section ES&H personnel when operating UV radiation sources (180-400nm).
- Enclose UV radiation source operations when possible to protect workers from an exposure. The enclosure shall be interlocked or require a tool to access the UV radiation source. Label the enclosure with a UV radiation warning label (Figure 1). The warning label can be obtained from your ES&H Section or the SLSO.

If the UV light source must be operated outside of the enclosure, check the TLV literature in the technical appendix for exposure durations and wear PPE such as UV blocking and full coverage clothing or sunscreen. Be sure that the PPE is rated for the spectrum of UV radiation that is in operation.

Figure 1



Welding, Burning and Brazing (WBB) (Required)

Fermilab employees are required to follow the requirements found in [FESHM Chapter 6020.2 Welding, Burning and Brazing](#) which identifies safety precautions, including personal protective equipment, curtains and screens.

Outdoor Work (Recommendation)

Outdoor work where eyes and skin may be exposed to UV radiation: whenever practical, wear long sleeves, long pants and a hat. When you know your skin will be exposed to the sun, apply generous amounts of sun block with an SPF rating of at least 15. Apply the sun block at least a half hour before going outside. Wear UV blocking sunglasses.